Genetic resources of Spanish hulled wheats[1]

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SUMMARY – Emmer (*Triticum turgidum* ssp. *dicoccum* Schrank em Thell, syn *T. dicoccon* Schrank) and spelt (*T. aestivum* ssp. *spelta* L. em Thell.) are two hulled wheats that are still grown in some Spanish regions, mainly in Asturias (North of Spain), where are indistinctly named as *escanda*. One recent collecting mission carried out in this Spanish zone has showed the scarce presence of emmer (4 populations), together with the presence of foreigner spelt that could change the genetic patrimony of the *escanda*, because of present agronomic characteristics more adapted to the present requirements than the autochthon spelt lines. This supposes one clear danger to the maintaining of these hulled wheats, together with the lost of diversity associated to them. The endosperm storage proteins have showed to be good markers for measure of this diversity. The analysis of the autochthon populations collected showed wide variation for the storage proteins, also as for morphological traits. In conclusion, we think that the evaluation of these genetic resources could be useful for enlarging the background of the modern wheats. Likewise, for the obtaining of *escanda* lines with better agronomical, morphological and quality traits than the actual lines, with the advantage of to be materials adapted to the special conditions of the cultivated zone.

Introduction

The term "hulled wheat" is applied to the wild or cultivated species of the genus *Triticum* that having the characteristic to present the glumes close to the grain even after the normal threshing. Another characteristic of these wheats is the presence of semi-brittle rachis, which is codified by a mutation of the *Q* gene, located in the chromosome 5A (Luo *et al.,* 2000). Species with these characteristics have been found for the three levels of ploidy (diploid, tetraploid and hexaploid) present in the genus *Triticum*: einkorn (*Triticum monococcum* L. ssp. *monococcum*; 2n=2×=14, AA), emmer (*T. dicoccon* Schrank; 2n=4×=28, AABB), and spelt or dinkel wheat (*T. aestivum* ssp. *spelta* L. em Thell; 2n=6×=48, AABBDD).

In the last years, for social, cultural or simply for profit reasons, the hulled wheats have began to be newly popularised in Europe, probably associated with the increasing interest in low-input systems due to the actual ecological and economical situation. Today, these wheats are in fashion food for which the consumers are disposed to pay prices higher than other foods derived from naked wheats. However, the diversity present in these crops is steadily eroded, due to their abandon for decades, and the use of seeds with a common origin. These processes of genetic drift and loss of biodiversity could be irreversible in many cases. For these reasons, the preservation and conservation of these crops still in hands of traditional farmers could be decisive in the maintenance of the remained diversity. On-farm conservation is increasingly recognised as a key component of any strategy to conserve crop genetic resources (Brush and Meng, 1998; Zeven, 2000). Moreover, this conservation involves the maintenance of traditional crop varieties (generally known as *landraces*) and crop systems by farmers within traditional agricultural systems, together with no introduction of foreign material (Altieri and Merrick, 1987; Oldfield and Alcorn, 1987; Brush and Meng, 1998). In fact, one of the objectives of on-farm conservation is the promotion of traditional varieties.

Nowadays, *escanda* (generic term used for both emmer and spelt) survive in marginal areas of Asturias (North of Spain), where traditional farming system still survive and is at risk of extinction (Peña-Chocarro and Zapata-Peña, 1998).

The variability for the hulled wheats in Spain was studied in the Nineteenth Century by Lagasca

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and Clemente in their unpublished "*Ceres Hispanica*" herbarium (Téllez-Molina and Alonso-Peña 1952). In this work, up to seven botanical varieties for spelt (var. *albivelutinum* Körn., var. *album* (Alef.) Körn., var. *arduini* (Mazz.) Körn., var. *caeruleum* (Alef.) Körn., var. *duhamelianum* (Mazz.) Koern., var. *rubrivelutinum* Körn., and var. *vulpinum* (Alef.) Körn.) and ten for emmer (var. *atratum* (Host.) Körn., var. *dicoccon* Körn., var. *inerme* Körn., *lagascae* Al. et Tell., nom. nud., var. *macratherum* Körn., var. *majus* Körn., var. *pseudomacratherum* Flaksb., var. *pycnurum* Alef., var. *rufum* Schübl., and var. *tricoccon* (Schübl.) Körn.) are described. More recently, Szabó and Hammer (1996) classified the European spelt in two groups (*mutica* and *aristata*) that included seven botanical varieties for each one. Both classifications were carried out according with glumes colour, presence or absence of awns, awns colour, pubescent or glabrous glumes, and kernel colour.

New collecting mission and evaluation of the diversity

Recently, we have carried out diverse works for evaluating of some old Spanish germplasm collections, establishing the level of variability and genetic diversity for endosperm storage proteins. These studies have been carried out with 102 accessions of emmer (Pflüger *et al*., 2001) and 405 accessions of spelt (Caballero *et al*., 2001, 2004abc). This material showed great variability for the storage proteins composition, detecting some novel allelic variants which have been included in the Catalogue of Wheat Gene Symbol (McInstosh *et al.;* 1998).

In August 2004, a collection mission was carried out in Asturias (Caballero *et al*., 2006), with the finality to evaluate the actual genetic variability of these crops. During this mission, it was observed the disappearance of the crops in some traditional localities, together with the appearance in localities where there was not historical data of its cultivation (Alvargonzález, 1908; Peña-Chocarro, 1996). A total of 32 populations of spelt and four populations of emmer were found.

Five of seven botanical varieties described by Lagasca and Clemente for and two of ten botanical varieties for emmer were detected in the present material. Awnless spikes were not found in any spelt and emmer populations. Other spikes types for spelt that were not mentioned by previous authors have been also found in the actual materials. In the material collected, it was frequent found spelt with yellow spikes (both with smooth and hairy glumes). The high frequency could be the consequence of the seed material exchange among the farmers of different localities. Although the land area has been increased in the last years, the original agrobiodiversity could have suffered an important recession. Emmer is sharply in recession and seems to be near to extinction because this species is considered as a weed by most of the farmers.

The HMW glutenin subunit composition of spelt populations collected in Asturias are being analysing (unpublished results) and it has been observed the disappearance of all new allelic variants found by Caballero *et al.* (2001). Furthermore, there is a great homogeneity between the populations. This homogeneity could be the consequence of the seed material exchange among the farmers of different localities. To this problem, it is added the presence of foreign material, German or Swiss, used by the farmers, that is awnless and with low height, which permits the mechanic harvest. Because of these low height materials could be more acceptable due to their profit, the danger of the neglect and disappearance of the traditional varieties is higher.

Due to the fact that the farmers are essential for the maintenance of these genetic resources, it is important to evaluate their preferences with respect to these crops. The main demands of the farmers were the attainment of material with low plant height for avoiding the lodging and that present spikes with white glumes without awns. This former demand is associated with the belief that materials with awns or other glumes colour have low bread-making quality. Consequently, these spike types are being lost in the present material.

Conclusions

The safeguard of these populations *in situ* is fundamental in maintaining diversity for this crop. Although new types of spelt have been detected, the miss of the two botanical varieties, that were found at pass in this zone, suggest that this on-farm conservation system, without one parallel *ex-situ* conservation, is clearly insufficient for the maintenance of the genetic diversity. Nowadays, this

conservation system has one critical point in the higher age of the farmers, together with the scarce interest for the maintenance of these materials for their descendents. This alarming disinterest of the new generations of farmers for the traditional varieties of *escanda* and the introduction of the foreign spelt varieties without any control, the traditional varieties of *escanda* gradually lose its genetic diversity. For this reason, the survival of this crop can be seriously endangered if the necessary actions for integrating of this activity within the Spanish *ex-situ* conservation programmes have not developed.

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